ISSN (print) 0093-4666 © 2014. Mycotaxon, Ltd. ISSN (online) 2154-8889

MYCOTAXON

http://dx.doi.org/10.5248/127.103

Volume 127, pp. 103–109 *January–March 2014*

Mensularia lithocarpi sp. nov. from Yunnan Province, southwestern China

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Abstract — *Mensularia lithocarpi* is described and illustrated from Yunnan Province, southwestern China. Both morphological and phylogenetic evidence indicates the new species belongs to *Mensularia*. It is distinguished from two quite similar species, *Mensularia nodulosa* and *M. hastifera,* by the combination of lack of hymenial setae, presence of hyphoid setae, smaller basidiospores, and growth on *Lithocarpus chintungensis* in southwestern China.

Key words — *Hymenochaetaceae, Hymenochaetales,* polypore, taxonomy

Introduction

Mensularia Lázaro Ibiza is one of four genera segregated from *Inonotus* P. Karst. sensu lato (Dai 2010: 264). This genus is typified by the *Boletus radiatus* Sowerby (≡ *Mensularia radiata* (Sowerby) Lázaro Ibiza; Ryvarden 1991). *Mensularia* differs from *Inonotus* sensu stricto and the other three segregate genera (*Inocutis* Fiasson & Niemelä, *Inonotopsis* Parmasto, and *Onnia* P. Karst.) by its strongly cyanophilous basidiospores (Dai 2010). It is also characterized by annual basidiocarps on angiosperms, a monomitic hyphal system, and presence of hymenial setae (Ghobad-Nejhad & Kotiranta 2008). Wagner & Fischer (2001), who confirmed *Mensularia* as an independent genus through their nuclear large subunit rDNA (nLSU)-based phylogeny, added two species, *M. hastifera* (Pouzar) T. Wagner & M. Fisch. and *M. nodulosa* (Fr.) T. Wagner & M. Fisch. Later, *M. crocitincta* (Berk. & M.A. Curtis) T. Wagner & M. Fisch. was included in *Mensularia* based on morphological characters, in contradiction to the phylogenetic evidence (Wagner & Fischer 2002). Currently, these four species are accepted in this phylogenetically heterogeneous genus.

In China, only one *Mensularia* species, *M. radiata,* was previously recorded (Dai 2012), although many new species belonging to poroid *Hymenochaetaceae*

have been originally described (Dai & Cui 2005, Cui & Dai 2008, Dai et al. 2008, Cui et al. 2009, Zhou & Jia 2010, Zhou & Dai 2012, Zhou & Qin 2012, 2013, Zhou & Xue 2012, Cui & Decock 2013, Zhou 2013, 2014). During repeated field surveys for polypores in 2013, an unknown specimen was collected in Yunnan Province, southwestern China. This specimen, which is both morphologically and phylogenetically supported as a new *Mensularia* species, is described and illustrated here. An identification key to worldwide species of *Mensularia* adapted from Ghobad-Nejhad & Kotiranta (2008) is provided.

Materials & methods

The studied specimens were deposited at the herbaria of Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang, P.R. China (IFP), Institute of Microbiology, Beijing Forestry University, Beijing, P.R. China (BJFC), and Botanical Museum, Finnish Museum of Natural History, Helsinki, Finland (H). The microscopic procedure follows Zhou (2013). The following abbreviations are used: L = mean basidiospore length (arithmetic average of all basidiospores), W = mean basidiospore width (arithmetic average of all basidiospores), Q = the L/W ratio, and n = number of basidiospores measured/number of specimens measured. Sections prepared in Melzer's reagent, Cotton Blue and 5% potassium hydroxide were studied using a Nikon Eclipse 80i microscope at magnification ×1000. When presenting the variation in basidiospore size, the upper and lower 5% of measurements are excluded from the range and the extreme values are presented in parentheses. Line drawings were made with the aid of a light tube. Special color terms follow Petersen (1996).

Phire® Plant Direct PCR Kit (Finnzymes Oy, Finland) was used to amplify nLSU from herbarium specimen Dai 13235 with primers LR0R and LR7 (Vilgalys & Hester 1990). The PCR product was sequenced with same primers. The newly generated sequence was deposited at GenBank (http://www.ncbi.nlm.nih.gov/genbank). Other nLSU sequences (Figure 1) from species of *Inonotus* sensu lato were downloaded from GenBank for phylogenetic analysis. The nLSU from *Phellinus igniarius* (L.) Quél. was also downloaded as outgroup according to Wagner & Fischer (2001). The dataset was aligned using ClustalX 2.0 (Larkin et al. 2007) with default parameters. The neighbor-

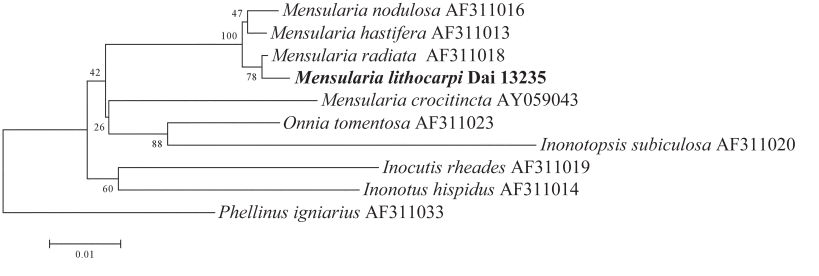

Figure 1. Neighbor-joining tree from nLSU sequences, indicating the phylogenetic position of the *Mensularia lithocarpi* holotype (Dai 13235).

joining (NJ) tree was constructed using MEGA 5 (Tamura et al. 2011) based on Maximum Composite Likelihood of nucleotide model and complete deletion of gaps/missing data with 1,000 bootstrap replicates.

Taxonomy

Mensularia lithocarpi L.W. Zhou, **sp. nov.** FIGURES 2, 3

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Differs from *Mensularia nodulosa* by its lack of hymenial setae, its hyphoid setae, and its smaller basidiospores.

TYPE: China. Yunnan Province, Pu'er, Jingdong County, Ailaoshan Nature Reserve, on rotten wood of *Lithocarpus chintungensis* Y.C. Hsu & H.J. Qian (*Fagaceae*), 13.VII.2013, Dai 13235 (**holotype**, BJFC; **isotype**, IFP; GenBank KF684968).

ETYMOLOGY: *lithocarpi* (Lat.): refers to the host genus.

BASIDIOCARPS annual, resupinate to nodulose-pileate on the effused part, inseparable, without odor or taste when fresh, up to 5.2 cm in longest dimension, 3 cm wide. PILEI projecting up to 2 mm, 7 mm wide, and 3 mm thick at base. PILEAL SURFACE glabrous, straw-yellow; MARGIN obtuse, honey-yellow. PORE SURFACE straw-yellow to honey-yellow; STERILE MARGIN distinct, first straw-yellow, later honey-yellow, up to 5 mm wide; PORES angular, 4–6

FIGURE 2. *Mensularia lithocarpi* (holotype). Basidiocarps.

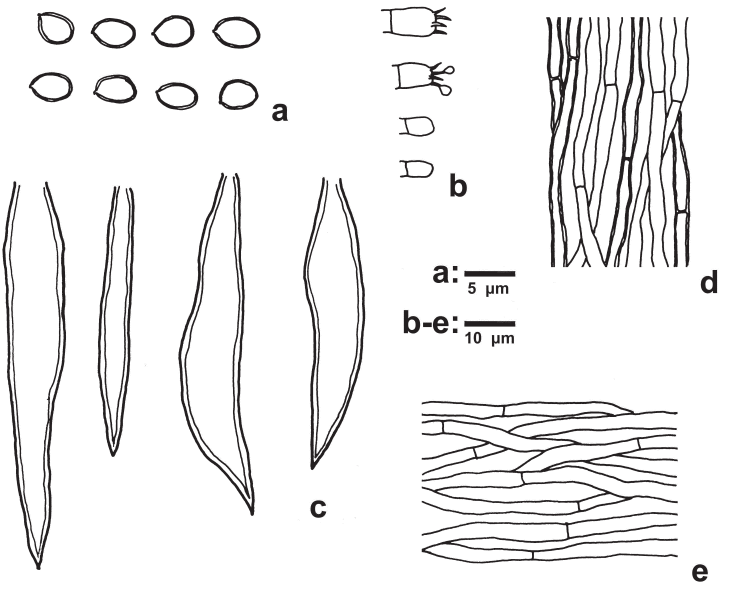

Figure 3. *Mensularia lithocarpi* (holotype). a: Basidiospores. b: Basidia and basidioles. c: Hyphoid setae. d: Hyphae from trama. e: Hyphae from subiculum.

per mm; dissepiments thin, entire to occasionally lacerate. Subiculum straw-yellow, corky, up to 0.5 mm thick. Tubes concolorous with subiculum, corky, up to 5 mm long on oblique part.

Hyphal system monomitic; generative hyphae simple septate; tissue becoming reddish brown but otherwise unchanged in 5% potassium hydroxide. Contextual hyphae hyaline to pale yellowish, thin-walled with a wide lumen, unbranched, frequently simple septate, straight, regularly arranged, 2–4 µm in diam.; tramal hyphae hyaline to yellowish, thin- to slightly thick-walled with a wide lumen, unbranched, frequently simple septate, straight, subparallel along the tubes, 3–4.5 µm in diam. Hymenial setae absent; hyphoid setae prominent, brown to dark brown, thick-walled with a wide lumen, sometimes penetrating into hymenium, up to several hundred µm long and 15 µm in diam. in the widest part, apex sharp-pointed; cystidia and cystidioles absent. Basidia barrel-shaped, hyaline, thin-walled, with four sterigmata and a simple septum at the base, 7–11 × 4–7 µm; basidioles similar to basidia in shape, but slightly smaller. Basidiospores ellipsoid, hyaline, slightly thick-walled, smooth, inamyloid and non-dextrinoid, strongly cyanophilous, (3.8–)3.9–4.6(–4.9) × (2.8–)2.9–3.5(–3.7) µm, L = 4.19 µm, W = 3.19 µm, Q = 1.31 (n = 30/1).

Other specimen examined: *Mensularia nodulosa*. **POLAND**, **Województwo krakowskie**, Ojcowski Park Narodowy, on fallen trunk of *Fagus sylvatica,* 19.IX.1978 Tuomo Niemelä 1353 (H; duplicate, IFP).

Remarks: *Mensularia lithocarpi* has annual basidiocarps, a monomitic hyphal system, and strongly cyanophilous basidiospores, which are the diagnostic morphological characters of *Mensularia*. In the NJ tree (Figure 1) from an alignment with 864 sites of 10 taxa, *M. lithocarpi* clustered with *M. hastifera, M. nodulosa,* and *M. radiata* with strong support (100%), indicating the new species belongs to *Mensularia*. Ghobad-Nejhad & Kotiranta (2008) treated ventricose hymenial setae as a shared character of *Mensularia*. Because *M. lithocarpi* has abundant hyphoid setae and no hymenial setae, it would be better to consider the presence of setae (either hymenial or hyphoid) as the stable character of *Mensularia*.

Macroscopically, *M. lithocarpi* is quite similar to *M. nodulosa* by sharing annual and resupinate to nodulose-pileate basidiocarps. However, *M. nodulosa* has larger basidiocarps (4.5–5 × 3.5–4 μm), lacks hyphoid setae, and bears hymenial setae (Ryvarden 2005). *Mensularia hastifera* has hyphoid setae, but it differs from *M. lithocarpi* in the entirely resupinate basidiocarps, longer basidiospores (4.5–5.2 × 3–4 μm), and presence of hymenial setae (Ryvarden 2005).

In addition, *M. hastifera* and *M. nodulosa* grow primarily on *Fagus sylvatica* in Europe and eastward to the Caucasus and Turkey (Ryvarden 2005), while the type specimen of *M. lithocarpi* inhabits *Lithocarpus chintungensis* in southwestern China.

World key to species of *Mensularia*

1a. Pores 7–9 per mm, known only from the Caribbean . . . . . *M. crocitincta*
1b. Pores <7 per mm, known from other parts of the world than the Caribbean 2
2a. Basidiocarps distinctly pileate . . . . . *M. radiata*
2b. Basidiocarps resupinate or nodulose-pileate 3
3a. Growth mainly on *Fagus sylvatica;* hymenial setae present, basidiospores mostly >4.5 μm long 4
3b. Growth on *Lithocarpus chintungensis;* hymenial setae absent, basidiospores mostly <4.5 μm long . . . . . *M. lithocarpi*
4a. Basidiocarps entirely resupinate; both hymenial and hyphoid setae present . . . . . *M. hastifera*
4b. Basidiocarps resupinate to nodulose-pileate; hymenial setae present, hyphoid setae absent . . . . . *M. nodulosa*

Acknowledgements

I express my gratitude to Drs. Shuang-Hui He (Beijing Forestry University, China) and Josef Vlasák (Biology Centre of the Academy of Sciences of the Czech Republic,

Czech Republic) who reviewed the manuscript before final submission. The research was financed by the National Natural Science Foundation of China (Project No. 31200015) and the Youth Fund for Creative Research Groups, Institute of Applied Ecology, Chinese Academy of Sciences.

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